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**NAVAL WAR COLLEGE  
Newport, R.I.**

**The Primacy of Air Power in Contested Littorals**

**by**

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**Major, U.S. Air Force**

**A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.**

**The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.**

**Signature: \_\_\_\_\_**

**4 May 2012**

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### **Paper Abstract**

The evolving threat of accurate, long-range advanced anti-access / area-denial weapons poses a significant risk to U.S. forward deployed forces. Potential adversaries look to challenge U.S. maritime dominance as regional tensions rise over disputed territorial claims. Credible threats to U.S. Naval dominance require realistic assessment of the Air Force's contributions to maintaining maritime dominance. This paper highlights how the speed, range, and flexibility of air power support joint efforts in gaining and maintaining sea control in a contested littoral environment. It specifically addresses how both robust and unique service attributes provide force multiplying capabilities to the joint forces commander through the operational functions of intelligence, logistics, protection, and fires. Finally, the paper draws conclusions concerning the obsolescence and atrophy of several maritime force capabilities, and recommends areas for further research and development toward rectifying deficiencies in naval and joint capabilities and training.

*The argument has been advanced that the Air Force should be concerned with land objectives, and the Navy with objectives on and over the water. That distinction is to deny the peculiar quality of the air medium, the third dimension. The air is indivisible; it covers land and sea.*

General Carl A. Spaatz  
Chief of Staff, U.S. Air Force (1947-1948)

## **INTRODUCTION**

The United States emerged as a prominent leader on the world stage following the allied victories in World War II. Having sustained strategic interests around the globe, the U.S. remains constant in its commitment to allies while ensuring access to international markets. In safeguarding partners and bolstering security for global trade, the U.S. relies heavily on its navy to protect freedom of navigation in highly contested and critical maritime chokepoints. The forward presence symbolized by these powerful fleet forces has been the strategy of the United States for decades, providing for both a show of military might and a beacon of security and stability.

Since the onset of World War II, air power routinely plays a crucial role in maritime operations, providing surveillance, reconnaissance, strike, interdiction, protection, and logistical support. The speed, range, and flexibility of aircraft proved pivotal in every conflict since, so much so that naval strategy dictates the first requirement in establishing sea control is the attainment of air superiority. However, unlike the past several decades, the access and freedom of action the U.S. enjoys is becoming more contentious, as dispersion of advanced capabilities find their way to more and more state and nonstate actors. With the development of accurate, long-range advanced anti-access / area-denial (A2/AD) weapons, designed to deny freedom of movement and maneuver, U.S. military supremacy in certain parts of the world is being challenged. The asymmetric threat of A2/AD weapons poses a

significant risk to U.S. forward deployed forces whose focus is the defeat of naval adversaries and ship to shore power projection.<sup>1</sup> Air Force capabilities afford “rapid, maneuverable, and flexible element[s] in this environment,” significantly contributing to maritime domain control by extending the reach and flexibility of naval forces.<sup>2</sup> The rapidly evolving and ever-increasing challenges surrounding the world’s most contested maritime environments will require extensive use of Air Force air power in order to provide joint and coalition forces with the operational intelligence, logistics, protection, and fires required to gain and maintain sea control in a contested littoral environment.

The United States Air Force is well suited to significantly influence the maritime domain by virtue of its inherent “speed, range, and flexibility,” allowing rapid employment anywhere in the world in a matter of hours or days.<sup>3</sup> These inherent qualities enable Air Force forces to respond promptly to crisis by overcoming the tyranny of distance in a very compressed timeline. Through rapid mobilization and deployment to areas of contention, the Air Force effectively masses combat capability where needed, providing the Joint Forces Commander (JFC) with rapid response options in the opening hours of crisis. Considering the operational factors of time, space, and force, the ability of the Air Force to respond rapidly with massed combat power, despite geographic expanse, highlights a unique force multiplying capability. In order to highlight air power’s contributions to sea control, elements of Air Force Countersea Operations are discussed as they relate to the operational factors and functions in emerging A2/AD maritime environments.

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<sup>1</sup> U.S. Air Force, *Countersea Operations*, Air Force Doctrine Document (AFDD) 3-04 (Washington, DC: Department of the Air Force, 15 September 2005), 3-9, accessed 24 March 2012, <http://www.e-publishing.af.mil/>.

<sup>2</sup> AFDD 3-04, *Countersea Operations*, 2.

<sup>3</sup> AFDD 3-04, *Countersea Operations*, 9.

## **Operational Intelligence**

Key to any crisis or potential combat situation is the ability to quickly and correctly discern the enemy's situation and intentions. At the operational level, the need for current, accurate intelligence is paramount for commanders to assess a given situation, develop or adjust plans, and coordinate forces accordingly, in order to avoid significant delays resulting from late notice major operational planning adjustments. As a key element of countersea operations, maritime surveillance and reconnaissance leverages the persistent of Air Force assets, coupled with broad area search and track, to provide airspace control and battlespace awareness.

Air Force Intelligence, Surveillance, and Reconnaissance (ISR) deliver versatile surge capacity force packaging, capable of timely data collection. This versatility allows for rapid deployment into an area of interest and in many cases, prior to other forces arriving on station.<sup>4</sup> The over-the-horizon, broad area search and track capabilities provided by high altitude, long endurance, remotely piloted aircraft (RPA) allow for persistent maritime area surveillance and rapid coverage of vast areas.<sup>5</sup> Utilizing RPAs in this manner affords the JFC flexibility in several ways. In having persistent overhead data collection affords commanders continuous situational awareness, refining their ability to assess enemy orders of battle and stay ahead of evolving situations. This provides joint force commanders maximum flexibility to adjust operational plans and force deployments accordingly prior to or while forces are enroute to the area of operations. RPAs also offer the JFC significant risk mitigation measures by removing an otherwise high value, manned platform from a potentially high risk operational environment. Finally, RPAs provide the JFC, and his or her

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<sup>4</sup> AFDD 3-04, *Countersea Operations*, 35.

<sup>5</sup> AFDD 3-04, *Countersea Operations*, 35-36.

subordinate commanders, operational flexibility by conserving high demand assets such as aerial refueling assets and manned ISR platforms for other operations.

As the aforementioned discussion presents, the countersea operations element of maritime surveillance and reconnaissance utilizing Air Force platforms not only accentuates the balance of space and force, by maximizing domain awareness with minimal forces, but also supports several operational functions. Surveillance and reconnaissance provides the JFC critical operational intelligence updates required for accurate planning and operational execution. From broad-area surface search to near real-time tracking of vessels, the Air Force markedly enhances the combatant commander's ability to assess the maritime environment, affording flexibility during operational planning and execution based on relevant trends or early indications and warnings of enemy force structures and positions. This allows the commander to verify plans or adjust operational force requirements prior to, or during movement phases, ensuring adequate positioning of combat power when and where needed in preparation for maneuvering. In doing so, affording friendly forces operational protection through continued situational awareness, including status of enemy orders of battle and information critical to the countering hostile actions.

### **Operational Logistics**

The intelligence support the JFC receives enables him or her to better assess requirements and respond with proper force during times of crisis. Determining the appropriate balance of rapid force projection with the right combination of combat power for the operation is vital, especially when evaluating U.S. military force reductions and overseas base closures.<sup>6</sup> Since the commencement of major military operations hinges on closure of

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<sup>6</sup> Chairman, U.S. Joint Chiefs of Staff, *Deployment and Redeployment Operations*, Joint Publication (JP) 3-35 (Washington, DC: CJCS, 7 May 2007), III-5.



minimum force requirements, the JFC is increasingly dependent on the agility and mobility air power provides.<sup>7</sup> The ability of Air Force forces to rapidly mobilize and react to a crisis means that initial response with credible force takes place within days. As the air component of U.S. Transportation Command (USTRANSCOM), the Air Force's Air Mobility Command (AMC) provides for the rapid deployment, sustainment, and redeployment of U.S. forces through air lift, air refueling, and aeromedical evacuation.<sup>8</sup> As the worldwide aerial port manager and designated operator of aerial ports of embarkation (APOEs) and aerial ports of debarkation (APODs), AMC supports the time-phased force and deployment requirements, allowing "the JFC to commence decisive operations as quickly as possible."<sup>9</sup>

In addition to airlift, another force multiplying aspect of Air Force global mobility is its robust aerial refueling capability. A critical element of any operational plan, especially when considering the standoff distances associated with an A2/AD environment, is the availability of adequate tanker support. Aerial refueling platforms afford the JFC operational flexibility during planning by providing the means to expedite or flex accordingly during operational execution. Tankers enhance military movement over considerable distances by reducing the time required for force deployment into areas of operation. They also directly support intelligence efforts by prolonging loiter time for critical airborne surveillance, reconnaissance, early warning, and C2 platforms. Air-to-air refueling also empowers global reach by enhancing combat capability of long-range strike platforms, and extending the reach of land and carrier-based strike aircraft. The force-multiplying attributes of aerial refueling make this inimitable capability a critical component of the JFC's plan for air superiority.

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<sup>7</sup> U.S. Naval War College, *Forces/Capabilities Handbook*, Joint Military Operations Reference Guide (Newport, RI: U.S. Naval War College, July 2011), 154.

<sup>8</sup> Joint Military Operations Reference Guide, *Forces/Capabilities Handbook*, 98-99.

<sup>9</sup> Joint Military Operations Reference Guide, *Forces/Capabilities Handbook*, 142.

This is especially true when considering the extended range of operations affiliated with an A2/AD environment, requiring strike aircraft to conduct long-range, forcible entry operations to establish air superiority and local sea control.

In times of crisis, the requirement for time-sensitive response and sourcing of vital commodities demands prompt delivery to the point of need. Future operations where the U.S. finds itself challenged with operating in an A2/AD environment, the speed, endurance, and operational reach provided by Air Force global mobility will allow the “JFC to seize, retain, and exploit the initiative,” by defining the depth of decisive operations.<sup>10</sup>

### **Operational Protection**

Faced with the asymmetric threat of anti-access / area denial, and the fluidity of modern battlefields, requires the U.S. to seek every means possible to protect friendly forces positioned in harm’s way. As previously discussed, comprehensive intelligence assessments provide the JFC knowledge of enemy capabilities, but the potential threat of interdiction--especially during the early phases of force deployment--poses a significant challenge to the operational commander.<sup>11</sup> In order to accomplish effects of countersea operations in the maritime domain, the Air Force combines the traditional air power strengths of counterair operations, close air support (CAS), and space capabilities with anti-surface, anti-submarine, and mine warfare (MIW).<sup>12</sup>

Having command of the skies above the battlefield is imperative, whether over land or sea. Therefore, key to success for any operational plan is the early establishment of air superiority. As a tenet of air power, counterair operations comprise both offensive and

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<sup>10</sup> Chairman, U.S. Joint Chiefs of Staff, *Joint Logistics*, Joint Publication (JP) 4-0 (Washington, DC: CJCS, 18 July 2008), viii.

<sup>11</sup> JP 3-35, *Deployment and Redeployment Operations*, III-5.

<sup>12</sup> AFDD 3-04, *Countersea Operations*, 40-46.

defensive operations aimed at attaining and maintaining the degree of airspace control required for operational execution. While offensive counterair (OCA) provides indirect protection of friendly forces by destroying or denying the adversary's use of the air domain, defensive counterair (DCA) provides direct defense of friendly maritime forces against enemy air and missile attacks with airborne early warning and airspace control.<sup>13</sup>

The success of maritime and amphibious operations can hinge on support provided by air assets. To this end, the Air Force not only provides significant contributions to establishing air superiority--a requirement to safeguard amphibious forces transitioning from sea to land--but also through counterland air interdiction operations. A highly contested maritime environment requires significant suppression of enemy forces to occur prior to amphibious operations. Additionally, to reduce risk to friendly forces following lodgment requires continuous monitoring. The Air Force, therefore, is uniquely positioned to provide not only the long-range strike, ISR, and airlift capabilities required to conduct the A2/AD force entry, but also provide the operational protection through air superiority, interdiction, and joint close air support required during amphibious operations.

Airpower has long been employed against surface forces with considerable success, and today's Air Force retains the ability to effectively survey, target, track, and engage enemy maritime forces and can do so utilizing a variety of highly accurate, precision-guided assets.<sup>14</sup> Central to this critical competency is the Air Force's space based capabilities. Heavy investment in space based assets enhances protection of U.S. joint and coalition forces through global communications, early indications and warnings, positioning and navigation, and the robust capacity to identify threats, assess enemy strengths and determine potential

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<sup>13</sup> AFDD 3-04, *Countersea Operations*, 41.

<sup>14</sup> AFDD 3-04, *Countersea Operations*, 36-37.

vulnerabilities.<sup>15</sup> As the integration executive of Integrated Broadcast Service (IBS), Air Force ISR ensures all users have uninterrupted access to IBS data, providing the latest intelligence and enabling critical communications required for both force protection and successful operational execution.<sup>16</sup> Air Force Space Command also provides global positioning system (GPS) data to all U.S. forces through the use of the largest military satellite constellation in the world providing a precision capability upon which all air, surface, and subsurface assets rely.<sup>17</sup>

Deploying forces are extremely vulnerable during early movement phases, especially when considering the depth associated with modern anti-access and area denial environments. The slow transition of surface vessels further complicates the situation, providing increased opportunities for enemy interdiction. Should the U.S. find itself conducting maritime combat operations, the global strike capabilities of the Air Force provide the preemptive or coordinated early response needed to shape the battlespace.

### **Operational Fires**

The ability to execute long range operations has been an important corner stone of Air Force airpower since World War II. Despite the standoff distances associated with emerging anti-access / area denial threats, the speed, range, and versatility of air power affords the JFC the ability to conduct operational fires well into the depth of enemy defenses. In executing lethal and nonlethal fires, air power directly influences future operations by facilitating freedom of maneuver for follow-on forces. Conducting operations against a variety of

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<sup>15</sup> Schriever Air Force Base Official Web site, "Schriever Air Force Base," Accessed 14 April 2012, <http://www.schriever.af.mil/gps/>.

<sup>16</sup> Federation of American Scientists, "Integrated Broadcast Service," Accessed 14 April 2012, <http://www.fas.org/irp/program/disseminate/ibs.htm>.

<sup>17</sup> Schriever Air Force Base Official Web site, "Schriever Air Force Base," Accessed 14 April 2012, <http://www.schriever.af.mil/gps/>.

critical locations or capabilities such as naval bases, seaports, refueling, and supply locations where operations are “designed to delay, disrupt, destroy, or degrade enemy forces and critical facilities,” are some examples of how air power supports joint maritime operations with lethal fires.<sup>18</sup>

In addition to operational fires involving precision strike on critical facilities and infrastructure, the Air Force offers significant contributions to sea control by conducting aerial minelaying operations. As a key element of countersea operations, the Air Force provides the JFC with the only expeditious, large scale mining capability available to U.S. forces. Coupling high-volume minelaying capability with global reach, air power supports JFC operational requirements, even in an A2/AD environment, that would otherwise keep friendly surface units at bay. These mine warfare operations provide the JFC the ability to rapidly execute offensive mining, or mine countermeasure operations, thereby setting conditions for adversarial sea denial, or allowing friendly forces to establish and maintain sea control of important chokepoints and littorals.

To highlight an example of both lethal and nonlethal fires is the employment of special operations forces (SOF). The U.S. greatly relies on these highly trained personnel to prosecute overseas military operations, and the rapid infiltration of SOF units allows for decisive operational strikes deep into the enemy’s rear. Small units conducting operations such as precision application of firepower, information operations, sabotage, intelligence gathering, explosive ordinance disposal, hazard and obstruction removal, and establishment of local command and control (C2) provide extensive battlespace preparation.<sup>19</sup> The speed and agility of air power affords the JFC the ability to rapidly employ SOF, even in an A2/AD

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<sup>18</sup> Milan Vego, *Joint Operational Warfare: Theory and Practice* (Newport: U.S. Naval War College, 2009), VIII-60.

<sup>19</sup> Joint Military Operations Reference Guide, *Forces/Capabilities Handbook*, 96, 143-144.

environment, to conduct preemptive or rapid response operations designed to significantly reduce the risk of larger employing forces. The Air Force supports SOF movement by providing the avenue of lift for numerous unique capabilities. Examples include the capacity to airdrop the Navy Sea, Air, and Land (SEAL) Maritime Craft Air Deployable System (MCADS), or Air Force Special Tactics Squadrons (STS) ensuring air power interoperability between SOF and conventional forces during follow-on combat operations.

As a principle prerequisite for military operations, the establishment of air superiority and local sea control are critical to achieving success. The speed, range, and survivability of air power allow the execution of both lethal and nonlethal fires deep into enemy defenses. In conducting operational fires, air power directly influences future operations by neutralizing threats and facilitating freedom of maneuver for follow-on forces.

### **Counter Arguments**

The aforementioned discussion on the operational functions of intelligence, logistics, protection, and fires highlight Air Force attributes in supporting maritime operations in the contested littorals protected with modern anti-access / area denial capabilities. This is not to say, however, that operational force providers are limited to the Air Force. For example, U.S. maritime forces employ a variety of surveillance, reconnaissance, early warning, C2, and signals intelligence assets. Both manned and unmanned capabilities are organic to surface units and are capable of broad area maritime search and airborne early warning. Additionally, the inherent stealth capabilities of U.S. Navy submarines allow them to penetrate deep into enemy territorial waters, and unlike their floating counterparts, negate many of the A2/AD threats that pose significant risks to surface forces. These unique

characteristics afford submarines the opportunity to covertly conduct surveillance and reconnaissance of critical maritime environments and enemy orders of battle.

The Navy also has the indigenous capability to provide at-sea sustainment and force protection. Bearing significant sea-based air, surface, and subsurface capability, Navy forces are highly effective at wielding combat power from the sea for prolonged periods. As previously mentioned, resident surveillance and reconnaissance capabilities enable regional battlespace awareness, while Naval and Marine aviation provide air warfare, air defense, and maritime air support to protect the large surface combat forces and the sea lines of communication.

U.S. naval forces also maintain the ability to conduct mine warfare. Vested capabilities reside with submarine and strike aircraft capable of conducting minelaying as determined by operational requirements. Emplacement via submarine affords the JFC a stealth platform, capable of deep penetration into an A2/AD environment, minimizing potential for adversarial detection and affording an element of surprise. Carrier-based strike and land-based maritime search aircraft provide the Navy with the means to conduct aerial minelaying, affording the JFC with the speed and flexibility found with Air Force mining platforms.

Although U.S. maritime forces employ a variety of manned and unmanned surveillance, reconnaissance, early warning, C2, and signals intelligence assets, they are limited in availability and loiter time compared to the high endurance Air Force counterparts. As for submarines, although the reconnaissance information provided can be of key importance, the speed and sensor range capabilities affiliated with submarine operations is ineffective at covering broad areas, limiting the information provided to more tactical levels

of intelligence. Therefore, despite intelligence assets being resident to the U.S. Navy, the ability to effectively concentrate significant surveillance and reconnaissance assets capable of continuous operational assessment required during large maritime campaigns requires joint coordination with the Air Force.

When faced with a credible A2/AD threat, however, the resultant standoff distance requires naval surface forces, including vital sea-based strike capabilities, to remain at great distances from points of contention, negating the ability to provide forward presence and significantly reducing their capacity for power projection. Having phased out the long-range aerial refueling assets without replacement, present naval forces are left with limited short-range refueling options that require a one-for-one tradeoff of strike capabilities with that of a limited refueling one. Thus, employing carrier-based aircraft into a credible A2/AD threat environment without adequate support of Air Force tankers, inherently limits effective combat radii.

Although naval MIW is a highly viable option for the JFC and his or her operational planners, there are several limiting factors with utilizing U.S. submarines for mine laying operations. The first is the trade-off between weapons loads. In order for submarines to employ available submarine-launched mobile mines, they must reduce the number of torpedoes carried. This can severely limit their anti-surface and anti-submarine warfare capabilities in the event large enemy forces are encountered, or combatants bypass minefields. Also, current U.S. submarines are limited in the number of mines that can be carried, thereby restricting the effective size of the area mined to a relatively small chokepoint or narrow port entry. An important factor to note concerning the U.S. inventory of naval mines is that they are all shallow water systems, typically employed in less than two



hundred feet. This presents another limitation concerning U.S. submarines designed for high-speed, deep water operations. However, the most debilitating aspect of naval submarine mining is the phase out of sub-launched mobile mines at the end of fiscal year 2012, with no replacements system available.<sup>20</sup>

Having already retired all surface delivery vessels and faced with the inevitable loss of submarine mining capabilities, the Navy's sole MIW platforms reside in naval strike and maritime surveillance platforms. However, this capacity is wrought with severe limitations, as the Navy starts retiring the aging P-3C Orion aircraft from service in 2013, while the replacement platform remains years away from mine delivery capabilities.<sup>21</sup> Additionally, although the Navy recently started minelaying training for some of its strike aircraft, credible capacity, experience and proficiency with MIW has yet to be achieved.

Finally, the atrophy associated with decades of neglect due to mine-specific training focused on mine countermeasures (MCM) in favor of MIW, few trained mine specialists remain in service today. As a result, training consists of "received wisdom passed down by experts in the Mobile Mine Assembly Division of the Navy Munitions Command."<sup>22</sup> In fact, as indicated by Dr. Scott Truver in his April 2012 article, by mid-2011, the U.S. Navy only employed two minefield planners, "a retired Coast Guard captain and a Limited Duty/Surface Ordnance naval officer assigned to NMAWC [Naval Mine and Anti-Submarine Warfare Command]."<sup>23</sup>

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<sup>20</sup>Scott Truver, "Taking Mines Seriously: Mine Warfare in China's Near Seas," *Naval War College Review*, Spring (2012), accessed 24 March 2012, <http://www.usnwc.edu/getattachment/19669a3b-6795-406c-8924-106d7a5adb93/Taking-Mines-Seriously--Mine-Warfare-in-China-s-Ne>.

<sup>21</sup>*Ibid.*, 55.

<sup>22</sup>*Ibid.*, 56.

<sup>23</sup>*Ibid.*, 56.

Utilizing organic assets, the U.S. Navy can obtain intelligence and conduct operations that afford maritime force protection. The capabilities, however, are mostly limited to more tactical levels, directly supporting carrier strike or surface action groups. Additionally, although MIW technically exists, the retirement of obsolete platforms coupled with lack of new systems and decades of neglected training have resulted in a significant reduction in capability.

### **Conclusion**

The world today writhes with increasing challenges as military modernization efforts are fueled by the proliferation of advanced anti-access / area denial capabilities. This rapid evolution not only threatens international freedom of access to vitally important waterways, but directly challenges the traditional might and forward presence of U.S. forces. Faced with the burgeoning threats associated with long range, highly advanced weapon systems, major U.S. military operations in contested littorals require extensive use of air power to establish and maintain air superiority as a prelude to maritime operations. Highlighting Air Force contributions to sea control are its dynamic capacities to provide operational intelligence, logistics, protection, and fires.

The robust surveillance and reconnaissance capabilities maintained in the Air Force arm the JFC with vast maritime situational awareness, affording time critical information on enemy orders of battle. Keeping commanders attuned with current operational intelligence facilitates accurate planning and decision making, ensuring application of ample combat power when and where needed. The ability to rapidly mobilize in response to such a crisis enables prompt deployment and sustainment of U.S. forces through air lift, while the force-

multiplying attributes of aerial refueling enhance the combat reach and loiter of air operations.

In addition to sustained intelligence support and global mobility, air power ensures protection of friendly naval forces through the use of counterair operations, close air support, and space capabilities. In coupling broad area surveillance, reconnaissance, and early warning with persistence strike platforms, the Air Force can transition swiftly from defensive to offensive roles and engage an enemy prior to the arrival of other forces. Given the speed, range, and survivability of air power assets, the ability to conduct strikes deep into enemy territory not only neutralizes enemy threats, but directly influences future operations by facilitating freedom of maneuver for follow-on forces. In addition to traditional lethal fires conducted against critical military installations and support infrastructure, the Air Force provides high-volume, aerial minelaying and lift support for Special Operations Forces.

These functions do not solely reside in the abilities of the Air Force, however, as naval airborne platforms and submarines provide highly capable means for conducting surveillance and reconnaissance operations. The availability and associated loiter times of current naval platforms, however, is significantly less when compared to the robust inventory of high altitude, long endurance assets of the Air Force, while speed and sensor range limitations relegate submarine reconnaissance to mainly tactical levels. In addition, although mine warfare still exists, the Navy has seen a significant reduction in capability with the retirement of obsolete platforms coupled with lack of new systems and decades of neglected training.

With escalating tensions revolving around many of the world's busiest waterways, the United States must remain engaged and prepared for hostile action. The challenges affiliated

with advanced anti-access / area denial capabilities, however require the planning and execution of future U.S. operations to capitalize on the strengths of combined arms. With speed, range, and flexibility, the primacy of air power, in concert with naval forces, will ensure U.S. maritime dominance continues.

### **Recommendations**

- The United States Navy needs to reassess the importance that mine warfare will have on future maritime operations and develop a training program charged with creating mine warfare specialists armed with subject matter expertise and comprehensive abilities to plan, train, and conduct offensive and defensive mining operations which will play an important role in future combined arms operations surrounding contested littorals.
- The Department of Defense needs to replace the moribund submarine-launched mobile mine with more advanced capability in order to preserve the inherent stealth delivery abilities afforded by the modern submarine fleet.
- The U.S. Air Force needs to enhance training and joint exercise with Navy and Marine forces in order to gain proficiency in maritime air support and close air support of amphibious operations. To facilitate the development of standard operating procedures among the different service communities, the U.S. Air Force Weapons School and the U.S. Navy Strike Fighter Tactics Instructor programs need to coordinate and participate in large joint force training exercises, compile lessons learned, and develop combined arms operating procedures.

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